We claim:

1.   A motion vector calculating method, comprising the steps of:

(a) extracting a block from a reference picture corresponding to a

5   block of a current picture to be processed, the size of the block of the

reference picture being the same as the size of the block of the current

picture, the origin of the block of the reference picture matching the origin

of the block of the current picture;

(b) while moving the block of the reference picture in a

10   predetermined search area, obtaining a residual between the block of the

current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference

picture so as to calculate a motion vector;

(d) orthogonally transforming pixel data of a block of the reference

15   picture and pixel data of a block of the current picture; and

(e) obtaining a residual between orthogonally transformed data of

the block of the reference picture and orthogonally transformed data of

each block of the current picture.

20   2.   The motion vector calculating method as set forth in claim 1,

wherein step (d) is performed by Hadamard transforming method.

3.   The motion vector calculating method as set forth in claim 1, further

comprising the steps of:

25   dividing each of a block of the reference picture and a block of the

current picture into a plurality of blocks; and

orthogonally transforming each of the divided blocks.

4.   A record medium on which a motion vector calculating program has

30   been recorded, the motion vector calculating program causing a system

that has the record medium to perform the steps of:

(a) extracting a block from a reference picture corresponding to a block of a current picture to be processed, the size of the block of the reference picture being the same as the size of the block of the current picture, the origin of the block of the reference picture matching the origin of the block of the current picture;

(b) while moving the block of the reference picture in a predetermined search area, obtaining a residual between the block of the current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference picture so as to calculate a motion vector;

(d) orthogonally transforming pixel data of a block of the reference picture and pixel data of a block of the current picture; and

(e) obtaining a residual between orthogonally transformed data of the block of the reference picture and orthogonally transformed data of each block of the current picture.

5.   The record medium as set forth in claim 4,   wherein step (d) is performed by Hadamard transforming method.

6.   The record medium as set forth in claim 4, further comprising the steps of:

dividing each of a block of the reference picture and a block of the current picture into a plurality of blocks; and

orthogonally transforming each of the divided blocks.

7.   A motion vector calculating method, comprising the steps of:

(a) extracting a block from a reference picture corresponding to a block of a current picture to be processed, the size of the block of the reference picture being the same as the size of the block of the current picture, the origin of the block of the reference picture matching the origin of the block of the current picture;

(b) while moving the block of the reference picture in a predetermined search area, obtaining a residual between the block of the current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference

5   picture so as to calculate a motion vector;

(d) while calculating a residual between pixels of a block of the reference picture and pixels of a block of the current picture, comparing the obtained residual with a predetermined threshold value; and

(e) when the residual is larger than the predetermined threshold

10   value, stopping the calculation of the motion vector; and

(f) setting the initial value of the predetermined threshold value corresponding to a characteristic of a picture.

8.   The motion vector calculating method as set forth in claim 7,

15   wherein the initial value of the predetermined threshold value is set corresponding to the sum of the absolute values of the difference values between values of pixels of the same picture and the mean value of the pixels thereof.

20   9.   The motion vector calculating method as set forth in claim 7,

wherein the initial value of the predetermined threshold value is set corresponding to a residual at the origin.

10.   The motion vector calculating method as set forth in claim 7,

25   wherein the initial value of the predetermined threshold value is set corresponding to the sum of the absolute values of the difference values between values of pixels of the same picture and the mean value of the pixels thereof and a residual at the origin.

30   11.   The motion vector calculating method as set forth in claim 7,

wherein the predetermined threshold value is the minimum value of residuals that have been obtained so far.

12.   A record medium on which a motion vector calculating program has been recorded, the motion vector calculating program causing a system that has the record medium to perform the steps of:

5   (a) extracting a block from a reference picture corresponding to a block of a current picture to be processed, the size of the block of the reference picture being the same as the size of the block of the current picture, the origin of the block of the reference picture matching the origin of the block of the current picture;

10   (b) while moving the block of the reference picture in a predetermined search area, obtaining a residual between the block of the current picture and the block of the reference picture;

          (c) detecting a block with the minimum residual from the reference picture so as to calculate a motion vector;

15   (d) while calculating a residual between pixels of a block of the reference picture and pixels of a block of the current picture, comparing the obtained residual with a predetermined threshold value; and

          (e) when the residual is larger than the predetermined threshold value, stopping the calculation of the motion vector; and

20   (f) setting the initial value of the predetermined threshold value corresponding to a characteristic of a picture.

13.   The record medium as set forth in claim 12,
          wherein the initial value of the predetermined threshold value is set
25   corresponding to the sum of the absolute values of the difference values between values of pixels of the same picture and the mean value of the pixels thereof.

14.   The record medium as set forth in claim 12,
30   wherein the initial value of the predetermined threshold value is set corresponding to a residual at the origin.

15. The record medium as set forth in claim 12,

wherein the initial value of the predetermined threshold value is set corresponding to the sum of the absolute values of the difference values between values of pixels of the same picture and the mean value of the

5 pixels thereof and a residual at the origin.

16. The record medium as set forth in claim 12,

wherein the predetermined threshold value is the minimum value of residuals that have been obtained so far.

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17. A motion detecting apparatus, comprising:

extracting means for extracting a plurality of macro blocks from a picture;

first motion detecting means for detecting a motion vector of each

15 of the plurality of macro blocks extracted by said extracting means;

motion calculating means for calculating a motion vector of the entire picture with motion vectors of individual macro blocks detected by said first motion detecting means; and

second motion detecting means for calculating a motion vector of

20 each macro block with the motion vector calculated by said motion calculating means.

18. The motion detecting apparatus as set forth in claim 17,

wherein said extracting means extracts a plurality of adjacent

25 macro blocks.

19. The motion detecting apparatus as set forth in claim 17,

wherein said extracting means extracts a plurality of macro blocks from each of areas into which the entire picture is divided.

30

20. A motion detecting method, comprising the steps of:

(a) extracting a plurality of macro blocks from a picture;

(b) detecting a motion vector of each of the plurality of macro blocks that have been extracted;

5 (c) calculating a motion vector of the entire picture with motion vectors of individual macro blocks that have been detected; and

(d) calculating a motion vector of each macro block with the motion vector that have been calculated.

10 21. The motion detecting method as set forth in claim 20,

wherein step (a) is performed by extracting a plurality of adjacent macro blocks.

22. The motion detecting method as set forth in claim 20,

15 wherein step (a) is performed by extracting a plurality of macro blocks from each of areas into which the entire picture is divided.

23. A picture encoding apparatus, comprising:

motion detecting means for detecting a motion vector of a

20 predetermined pixel block of input picture data and generating motion residual information;

determining means for comparing the motion residual information received from said motion detecting means with a predetermined value and generating a determined result;

25 picture data process means for performing a predetermined process for picture data, the predetermined process being required for an encoding process;

encoding means for performing the encoding process for picture data; and

30 controlling means for skipping the predetermined process performed by said picture data process means corresponding to the determined

result of said determining means and causing said encoding means to perform the encoding process.

24. The picture encoding apparatus as set forth in claim 23,

    wherein said motion detecting means calculates a mean discrete residual of each pixel block, and

    wherein said determining means compares the mean discrete residual with the predetermined value.

25. The picture encoding apparatus as set forth in claim 23, further comprising:

    value determining means for determining the predetermined value with information obtained in the encoding process,

    wherein said determining means generates the determined result with the predetermined value determined by said value determining means.

26. A picture encoding method, comprising the steps of:

    (a) detecting a motion vector of a predetermined pixel block of input picture data and generating motion residual information;

    (b) comparing the motion residual information with a predetermined value and generating a determined result;

    (c) performing a predetermined process for picture data, the predetermined process being required for an encoding process; and

    (d) skipping the predetermined process corresponding to the determined result and performing the encoding process for the picture data.

27. The picture encoding method as set forth in claim 26,

    wherein step (a) is performed by calculating a mean discrete residual of each pixel block, and

wherein step (b) is performed by comparing the mean discrete residual with the predetermined value.

28. The picture encoding method as set forth in claim 26, further comprising the step of:

determining the predetermined value with information obtained in the encoding process,

wherein step (b) is performed by generating the determined result with the predetermined value that has been determined.

29. A motion vector calculating method, comprising the steps of:

(a) extracting a block from a reference picture corresponding to a block of a current picture to be processed, the size of the block of the reference picture being the same as the size of the block of the current picture, the origin of the block of the reference picture matching the origin of the block of the current picture;

(b) while moving the block of the reference picture in a predetermined search area, obtaining a residual between the block of the current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference picture so as to calculate a motion vector;

(d) extracting N pixels of the current picture and N pixels of the reference picture at a time (where N is an integer);

(e) storing the N pixels of the current picture and the N pixels of the reference picture as successive data to a memory; and

(f) reading pixels of the block of the current picture and pixels of the block of the reference picture as successive data from the memory so as to obtain a residual.

30. The vector calculating method as set forth in claim 29,

wherein the residual is calculated with an instruction that causes a plurality of successive data pieces to be processed at a time.

31. The vector calculating method as set forth in claim 29,

wherein N pixels of the current picture and N pixels of the

reference picture are extracted checkerwise at a time.

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32. A record medium on which a motion vector calculating program has

been recorded, the motion vector calculating program causing a system

that has the record medium to perform the steps of:

(a) extracting a block from a reference picture corresponding to a

block of a current picture to be processed, the size of the block of the

reference picture being the same as the size of the block of the current

picture, the origin of the block of the reference picture matching the origin

of the block of the current picture;

(b) while moving the block of the reference picture in a

predetermined search area, obtaining a residual between the block of the

current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference

picture so as to calculate a motion vector;

(d) extracting N pixels of the current picture and N pixels of the

reference picture at a time (where N is an integer);

(e) storing the N pixels of the current picture and the N pixels of

the reference picture as successive data to a memory; and

(f) reading pixels of the block of the current picture and pixels of

the block of the reference picture as successive data from the memory so

as to obtain a residual.

33. The record medium as set forth in claim 32,   wherein the residual

is calculated with an instruction that causes a plurality of successive data

pieces to be processed at a time.

30

34.   The record medium as set forth in claim 32,

wherein N pixels of the current picture and N pixels of the

reference picture are extracted checkerwise at a time.

5   35.   A motion vector calculating method, comprising the steps of:

(a) extracting a block from a reference picture corresponding to a

block of a current picture to be processed, the size of the block of the

reference picture being the same as the size of the block of the current

picture, the origin of the block of the reference picture matching the origin

10   of the block of the current picture;

(b) while moving the block of the reference picture in a

predetermined search area, obtaining a residual between the block of the

current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference

15   picture so as to calculate a coarse motion vector;

(d) while moving the block of the reference picture in the vicinity of

the coarse motion vector obtained at step (c), obtaining a residual

between the block of the current picture and the block of the reference

picture;

20   (e) detecting a block with the minimum residual from the reference

picture so as to detect a fine motion vector;

(f) storing pixels of the current picture and pixels of the reference

picture to a first memory;

(g) extracting N pixels of the current picture and N pixels of the

25   reference picture at a time (where N is an integer); and

(h) storing the N pixels of the current picture and the N pixels of

the reference picture as successive data to a second memory,

wherein step (c) is performed with the N pixels of the current

picture and the N pixels of the reference picture stored as successive data

30   in the second memory, and

wherein step (e) is performed with the pixels of the current picture

and the pixels of the reference picture stored in the first memory.

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36. The motion vector calculating method as set forth in claim 35,

wherein the residual is calculated with an instruction that causes a plurality of successive data pieces to be processed at a time.

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37. The motion vector calculating method as set forth in claim 35,

wherein N pixels of the current picture and N pixels of the reference picture are extracted checkerwise at a time.

10 38. A record medium on which a motion vector calculating program has been recorded, the motion vector calculating program causing a system that has the record medium to perform the steps of:

(a) extracting a block from a reference picture corresponding to a block of a current picture to be processed, the size of the block of the reference picture being the same as the size of the block of the current

15 picture, the origin of the block of the reference picture matching the origin of the block of the current picture;

(b) while moving the block of the reference picture in a predetermined search area, obtaining a residual between the block of the

20 current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference picture so as to calculate a coarse motion vector;

(d) while moving the block of the reference picture in the vicinity of the coarse motion vector obtained at step (c), obtaining a residual

25 between the block of the current picture and the block of the reference picture;

(e) detecting a block with the minimum residual from the reference picture so as to detect a fine motion vector;

(f) storing pixels of the current picture and pixels of the reference

30 picture to a first memory;

(g) extracting N pixels of the current picture and N pixels of the reference picture at a time (where N is an integer); and

(h) storing the N pixels of the current picture and the N pixels of the reference picture as successive data to a second memory,

wherein step (c) is performed with the N pixels of the current picture and the N pixels of the reference picture stored as successive data in the second memory, and

wherein step (e) is performed with the pixels of the current picture and the pixels of the reference picture stored in the first memory.

39.   The record medium as set forth in claim 38,

wherein the residual is calculated with an instruction that causes a plurality of successive data pieces to be processed at a time.

40.   The record medium as set forth in claim 38,

wherein N pixels of the current picture and N pixels of the reference picture are extracted checkerwise at a time.

41.   A motion vector calculating method, comprising the steps of:

(a) extracting a block from a reference picture corresponding to a block of a current picture to be processed, the size of the block of the reference picture being the same as the size of the block of the current picture, the origin of the block of the reference picture matching the origin of the block of the current picture;

(b) while moving the block of the reference picture in a predetermined search area, obtaining a residual between the block of the current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference picture so as to calculate a motion vector; and

(d) comparing contour pixels of the block of the reference picture with contour pixels of the block of the current picture so as to obtain a residual therebetween.

42. The motion vector calculating method as set forth in claim 41,
wherein step (d) includes the steps of:

cumulating the absolute values of the difference values between
the upper contour pixels of the block of the current picture and the upper
contour pixels of the block of the reference picture in a horizontal
scanning direction so as to obtain the sum thereof;

cumulating the absolute values of the difference values between
the left contour pixels of the block of the current picture and the left
contour pixels of the block of the reference picture in a vertical scanning
direction so as to obtain the sum thereof;

cumulating the absolute values of the difference values between
the right contour pixels of the block of the current picture and the right
contour pixels of the block of the reference picture in a vertical scanning
direction so as to obtain the sum thereof; and

cumulating the absolute values of the difference values between
the lower contour pixels of the block of the current picture and the lower
contour pixels of the block of the reference picture in a horizontal
scanning direction so as to obtain the sum thereof.

43. A record medium on which a motion vector calculating program has
been recorded, the motion vector calculating program causing a system
that has the record medium to perform the steps of:

(a) extracting a block from a reference picture corresponding to a
block of a current picture to be processed, the size of the block of the
reference picture being the same as the size of the block of the current
picture, the origin of the block of the reference picture matching the origin
of the block of the current picture;

(b) while moving the block of the reference picture in a
predetermined search area, obtaining a residual between the block of the
current picture and the block of the reference picture;

(c) detecting a block with the minimum residual from the reference
picture so as to calculate a motion vector; and

(d) comparing contour pixels of the block of the reference picture with contour pixels of the block of the current picture so as to obtain a residual therebetween.

5   44.   The record medium as set forth in claim 43 wherein step (d) includes the steps of:

cumulating the absolute values of the difference values between the upper contour pixels of the block of the current picture and the upper contour pixels of the block of the reference picture in a horizontal

10   scanning direction so as to obtain the sum thereof;

cumulating the absolute values of the difference values between the left contour pixels of the block of the current picture and the left contour pixels of the block of the reference picture in a vertical scanning direction so as to obtain the sum thereof;

15   cumulating the absolute values of the difference values between the right contour pixels of the block of the current picture and the right contour pixels of the block of the reference picture in a vertical scanning direction so as to obtain the sum thereof; and

cumulating the absolute values of the difference values between

20   the lower contour pixels of the block of the current picture and the lower contour pixels of the block of the reference picture in a horizontal scanning direction so as to obtain the sum thereof.